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First recorded sighting of the Critically Endangered Tricolour Langur, *Presbytis chrysomelas cruciger* (Thomas, 1892) (Primates, Cercopithecidae), in Jemoreng Protected Forest, Sarawak, Malaysia

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Abstract. *Presbytis chrysomelas cruciger* (Thomas, 1892) is a Critically Endangered langur subspecies that has rarely been studied due to the difficulty of encountering it in the wild. Previously, this subspecies was sighted in Maludam National Park, Sarawak, Malaysian Borneo. Here, we provide the first sighting record of *P. c. cruciger* in Jemoreng Protected Forest in Sarawak, where a total of eight groups were observed. We urge for further comprehensive studies and immediate conservation action.

Key words. Camera trap, Malaysian Borneo, Old World Monkey

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INTRODUCTION

Presbytis chrysomelas cruciger (Thomas, 1892), also known as the Tricolour Langur, is assessed as Critically Endangered in the IUCN Red List (Nijman et al. 2020). Its population has declined by approximately 80% over the past 30 years, and this trend is predicted to continue due to habitat loss from the expanding cultivation of oil palm (Nijman et al. 2020). The occurrence of this subspecies is confined to the peat swamp forest in Maludam National Park, Sarawak (Phillips and Phillips 2018). In 2019, a new sighting was recorded in Danau Sentarum National Park (DSNP), Indonesia (Rifqi et al. 2019). It was recorded at an elevation of 80–400 m a.s.l. in DSNP in a mixed lowland forest that mostly consisted of peatland forest with a few areas of dry land forest (Rifqi et al. 2019). This is consistent with the habitats used by this subspecies, as the subspecies is reported to occur in swamps, lowlands, and mangrove forests (Nijman et al. 2020; Santoso et al. 2023a, 2023b). These monkeys are diurnal, arboreal, eat fruits and leaves, and live in groups of 3–7 individuals, with one male, 1–3 females, and 8–15 offspring (Rifqi et al. 2019). Santoso et al. (2023a) collected information regarding Tricolour Langur's characteristic habitat, feeding ecology, daily activity, and canopy-stratum usage. They demonstrated that this species inhabits primary and mixed forests (swamp, cultivated land, and secondary forest) in Bukit Semujan, Lupak Mawang Resort, Danau Sentarum National Park. In addition, Santoso et al. (2023b) identified niches in common with Muller's Gibbon (*Hylobates muelleri* Martin, 1841) by analyzing their niche overlap and breadth that cause cohabitation.

According to the Sarawak Wildlife Protection Ordinance 1998, *Presbytis c. cruciger* is a fully protected primate species in Sarawak. However, no photographs or complete scientific reports of the ecology and behavior of this subspecies have been published from Maludam National Park. The extreme forest habitat, such as the deep peat swamp forest that is inhabited by crocodiles and various venomous snake species, and the high sensitivity to human presence could be the main contributing factors as to why there have been no intensive studies. In Indonesia, the behavioral ecology aspects of this subspecies have been studied in Danau Sentarum National Park (Rifqi et al. 2019; Santoso et al. 2023a, 2023b). By contrast, comparatively more studies are available on its sister subspecies, Bornean Banded Langur, *P. c. chrysomelas* (Thomas,

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1892), from Sarawak on behavioral ecology (Ampeng 2003, 2007; Ampeng and Md-Zain 2007, 2012), molecular systematics (Vun et al. 2011), and diversity based on the camera-trap method (Mohd-Azlan et al. 2018).

A general survey on the species biodiversity of Jemoreng Protected Forest (JPF) was conducted starting in May 2022 using camera traps that recorded a strange monkey in an unclear photo. Carefully examination revealed the monkey to be *P. c. cruciger*. This find has led to a more intensive camera-trap survey at possible locations to capture clearer images. Here, we reported the first sighting of *P. c. cruciger* in JPF, Sarawak, Malaysian Borneo.

METHODS

The survey was conducted at JPF, Sibu, Sarawak (Figure 1). The forest condition becomes extreme during the rainy season, with some areas having water depth exceeding 1.5 m, thereby making it difficult to walk. Dry-land areas are also affected by flooding during the rainy season. Trees are generally small and less than 30 m tall; this is primarily because of the soil condition of the peat swamp forest. Some emergent *Shorea* Roxb. ex C.F.Gaertn. species have been recorded, but rarely.

Four line transects were constructed and surveyed from October to November 2022. The difficult conditions of the peat swamp forest caused the transect length to be unevenly constructed. The transect distance lengths were as follows: transect 1 (T1) = 1.1 km, transect 2 (T2) = 300 m, transect 3 (T3) = 700 m, and transect 4 (T4) = 1.3 km, with the distance between each transect 2–5 km. In the second round of fieldwork, three new transects were constructed and surveyed from February to March 2023. Two transects were evenly established, with a distance of 2 km each, while one transect was built with a distance of 6 km, although it had to go through a deep peat swamp forest. All seven transects were surveyed, starting as early as 06:30–07:00 in the morning and ending in the late afternoon (18:40–18:45), depending on the transect distance. For every field trip, all seven transects were simultaneously surveyed daily. Two assistants for every transect were assigned daily for a total of 10,673 h to survey all transects. All constructed transects were fitted with Reconyx HyperFire-2 camera traps, and a total of 74 camera trap units were used. The number of installed units depended on the transect length, which was T1 = 20 units, T2 = 4 units, T3 = 6 units, T4 = 9 units, T5 = 10 units, T6 = 10 units, and T7 = 15 units. All camera traps were installed not at a fixed distance on flat and dry areas at a height of approximately 0.5–1 m above the ground. The third survey effort was conducted in August 2023.

RESULTS

Presbytis chrysomelas cruciger (Thomas, 1892)

Figure 2

New record. MALAYSIA – Sarawak • Jemoreng Protected Forest; Ahmad Ampeng; 02°42′00″N, 111°39′00″E; 5 m a.s.l.; 04.VII.2022, 23.VI.2023; camera-trap; peat swamp forest.

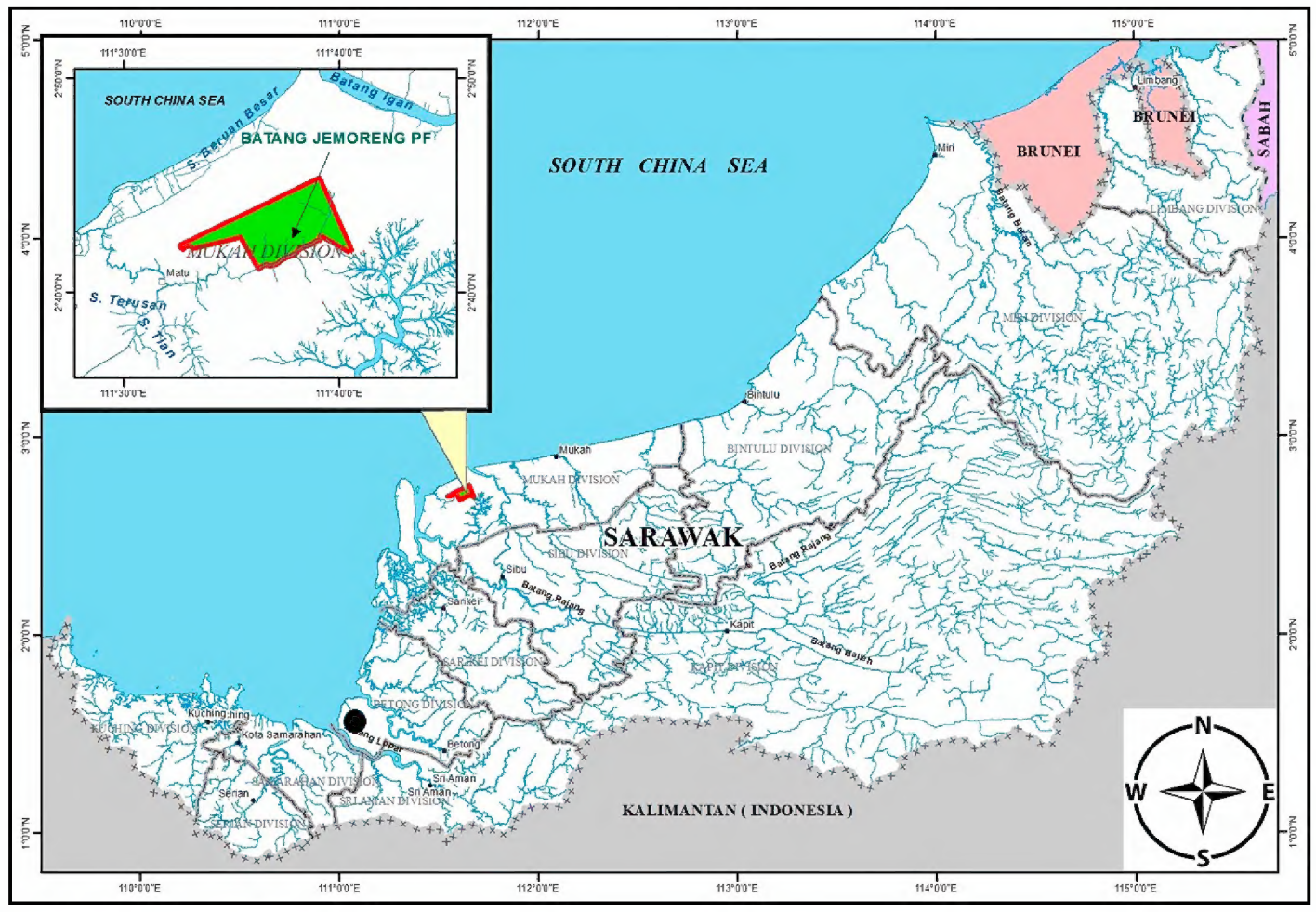

Figure 1. Map of the study area, Jemoreng Protected Forest, Sarawak, Malaysia. The black circle is the location of Maludam National Park, Sarawak, where Bornean Tricolour Langur also occurs.

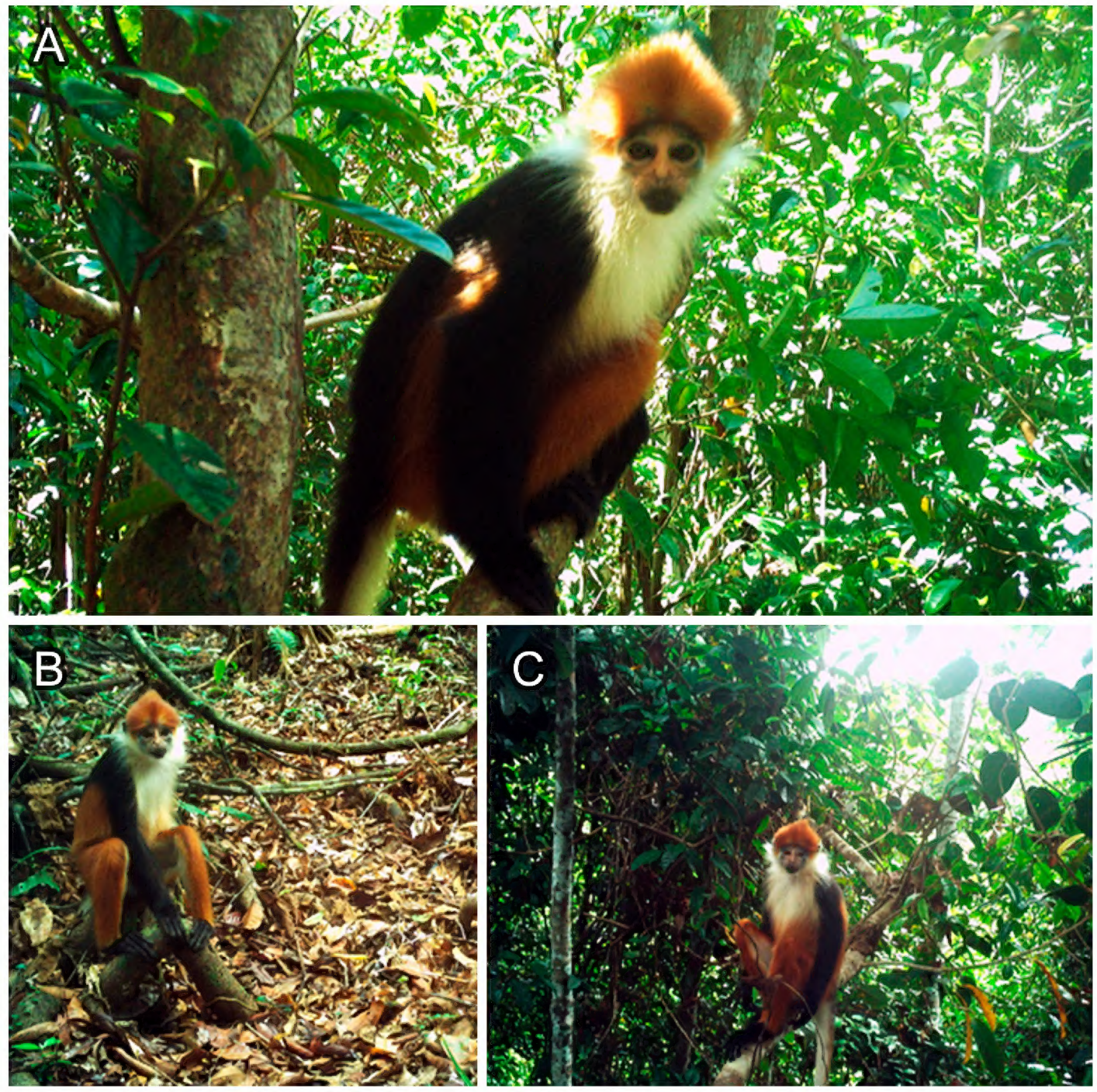

Figure 2. *Presbytis chrysomelas cruciger*, Tricolour Langur. **A.** Sitting on a branch of a *Cinnamomum* spp. tree. **B.** On the ground. **C.** On a branch. Photos by A. Ampeng.

Identification. Three clear images were recorded (Fig. 2A-C), which show that the face (cheeks), chest, and abdomen are white. The color pattern is slightly different from that reported in animals in DSNP (Rifqi et al. 2019; Santoso et al. 2023a). There is red-orange hair on head, sides of the abdomen, and feet, and the arms, hand, back, and tail are black. The subspecies *P. c. chrysomelas* has black and partly white hair on the body (Ampeng and Md-Zain 2012).

Observation. Three vocalization patterns were recorded: the short vocalization "tat..tat..", with a longer period between the first and next vocalization, and the longer vocalization "tat..tat..tat..tat..tat..tat..tat..", with a shorter interval between the first and next vocalization. A loud "tat..tat..tat..tat" vocalization was emitted when langurs detected researchers.

A camera-trap photograph from the preliminary analysis in August 2022 captured an image of a langur. It has been identified as an individual from the Critically Endangered nominal subspecies *P. c. cruciger* (Figure 3). The first detailed and comprehensive study of the existence of langurs in JPF was conducted on 2 October–30 November 2022. No images of *P. c. cruciger* were recorded by the camera traps, but direct observations recorded one group at T1, T4, and T5. Camera traps recorded one image of *P. c. cruciger*, while direct observation recorded a total of five *P. c. cruciger* groups in the second (February to March 2023) and third fieldwork surveys (August 2023). Therefore, eight groups of *P. c. cruciger* were recorded in the three fieldwork studies (Table 1). Of these, seven groups consisted of 3–7 individuals, including infants, while one large group was recorded to consist of >30 individuals at T3. However, these data are preliminary and the true size of the largest group cannot be confirmed. Tricolour Langurs were eating the unripe fruit from the *Auriculatum campnosperma* (Blume) Hook.f. tree. It is possible that individuals from different groups shared the same fruit tree. Only in one observation was a solitary individual observed; this was in transect T1. In addition, a group of *P. c. cruciger* was recorded eating the petioles of half-matured leaves of *Glochidion* J.R.Forst. & G.Forst. A camera trap in T5 recorded *P. c. cruciger* descending to the ground once to collect fallen seeds or for another, unknown reason.

Until the third field survey, the sleeping sites had not been precisely confirmed. Therefore, encounters were only made while patrolling the transects. Daily activity surveys indicate that the earliest that *P. c. cruciger* was recorded was 09:40 h. The data show that *P. c. cruciger* was active throughout the day, but that movements were slow. Feeding activity still occurred at 12:30 h and continued until evening.

Short vocalizations were recorded several times during the late morning between 10:00 h and 11:30 h.

Figure 3. First recorded image by camera trap during a biodiversity richness survey at Jemoreng Protected Forest in July 2022, which was suspected to be *Presbytis chrysomelas cruciger*, Tricolour Langur. Photo by **A.** Ampeng.

Table 1. *Presbytis chrysomelas cruciger*, Tricolour Langur, groups recorded at Jemoreng Protected Forest.

Transect	Transect length (m)	No. of groups	No. of individuals	No. of infants
T 1	1100	1	3	0
T 2	300	0	0	0
T 3	700	1	30	2
T 4	1300	1	7	0
T 5	2000	1	5	0
T 6	2000	1	7	1
T 7	6000	3	7, 5, 7	0

The interval between the first and next short vocalization was longer and estimated to be approximately 3–15 min. The longer vocalization was recorded in between 18:20 h and 18:40 h, when the sun was about to set. Compared to short vocalization in the morning, the interval between the first and next long vocalization made in the evening was approximately 30–60 s. Data on the recorded vocalization patterns at both times show that they were consistently produced by only one individual. A hard, loud "tat..tat..tat..tat.." vocalization was emitted when the langurs detected danger, and, in this case, they detected the presence of the researchers. This vocalization was produced by only one individual, while the other group members remained silent and moved away. This study found that the long-range vocalization of "tat..tat..tat..tat.." was released 4–5 times. A final long, hard, and loud "tat..tat..tat..tat.." vocalization indicated that all the members of the group were no longer traceable.

DISCUSSION

During the second and third field surveys, the *Presbytis chrysomelas cruciger* in JPF were sensitive to human presence in their environment. It appears that *P. c. cruciger in* JPF use a combination of their sense of sight, hearing, and smell to detect the presence of humans. This assumption is reinforced by the swamp forest characteristics such as soft soil, thick tree saplings, and invisible creepers in the water that greatly disrupt silent movement. Therefore, no images were perfectly obtained and the best recorded images are shown in Figure 2A–C.

The JPF is protected by the Sarawak Forest Ordinance Forest Ordinance 2015 (Cap. 71), which means that no one can encroach on the forest. The nearest local community settlement is 2 km away, with the majority being Muslims. This makes *P. c. cruciger* in JPF less threatened, as local communities do not practice primate hunting; however, rivers in JPF are sometimes used by the communities for fishing. A program of conservation awareness is advised to educate local communities on the importance of conserving langurs. The presence of *P. c. cruciger* and other important biodiversity finds, means that the Forest Department of Sarawak is now on the way to elevate JPF as a forest of high-conservation value.

Until now, no clear images had been available of *P. c. cruciger* from Maludam National Park (Phillips and Phillips 2018) to compare if this subspecies was similar or different, particularly in population-level color variations. The discovery of the Critically Endangered *P. c. cruciger* in JPF reveals that Maludam National Park is not the only area inhabited by this subspecies in Sarawak. Thus, JPF constitutes an important habitat for this Critically Endangered langur. This discovery provides an opportunity to obtain additional comprehensive ecological, behavioral, and genetic data of *P. c. cruciger* in Sarawak in the future. Since the coat coloration is varies between populations of *P. c. cruciger*, a comprehensive taxonomic revision of *P. c. cruciger* and *P. c. chrysomelas* is needed. These data that can be used as important information for the conservation management of this Critically Endangered species in Sarawak.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: AA, BMMZ. Funding acquisition and resource: HM, JL, MGP. Investigation: AA, SO, ERJ, RB, IH, MFAR. Methodology: AA, CT, SMN, BMMZ. Validation: BMMZ. Visualization: AA. Writing – original draft: AA. Writing – review and editing: BMMZ.

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Data availability

All data that support the findings of this study are available in the main text.

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